

## Sarcomas Near Extremity Joints in Adults

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**Background and Objectives:** There are technical difficulties in resecting soft tissue sarcomas extending to or crossing a joint. The objective of this study was to determine the rate of amputation and local recurrence rate for these sarcomas and compare them with the respective rates for overall extremity sarcomas.

**Methods:** Retrospective review of 78 patients with sarcoma near a joint compared with 215 patients with extremity sarcomas accrued during the same period, 1977–1994. Of these 78 patients, 64 were in the lower and 14 in the upper extremity. Most common histologic subtypes were malignant fibrous histiocytoma (15/78, 19%), synovial sarcoma (11/78, 14%), liposarcoma (11/78, 14%), and leiomyosarcoma (10/78, 13%). The surgical treatment consisted of local excision in 10 (13%), wide excision in 56 (72%), and amputation in 12 (15%). Adjuvant radiation was given to 26 patients.

**Results:** Local recurrence was noted in 20% (16/78) patients. The incidence of local recurrence in the surgery alone group ( $n = 52$ ) was 15% (8/52) and in the surgery plus adjuvant radiation group ( $n = 26$ ) it was 31% (8/26);  $P = 0.11$ . Of the 16 patients with local recurrence, 9 (56%) required amputation. The 5-year and 10-year survival rates for the entire group of patients were 68% and 60% respectively. On multivariate analysis survival varied according to grade ( $P = 0.05$ ) and tumor size ( $P = 0.02$ ).

**Conclusions:** Amputation was finally required in 27% (21/78) for local control of the disease. The local recurrence rate was 20%. These rates appear to be somewhat higher than those reported in our overall extremity sarcoma series and those in most modern series of overall extremity sarcomas, but the 5- and 10-year survival rates are similar to those of the latter. *J. Surg. Oncol.* 1998;67:164–167. © 1998 Wiley-Liss, Inc.

**KEY WORDS:** sarcomas near joints; local control; survival

### INTRODUCTION

Soft tissue sarcomas extending to the level of a joint or crossing a joint pose special technical challenges because of the presence of the joint and the crowding of neurovascular structures that occurs near joints. There is little information in the literature concerning the possibility of limb preservation or the local control and survival rates for these sarcomas. This report concentrates on the management and outcome for these tumors.

### MATERIALS AND METHODS

In the following review, a sarcoma was considered “near a joint” when it crossed the joint in its longitudinal

extent or the distance of the border nearest to the joint was  $<3$  cm to the radiologic joint space. Seventy-eight patients consisting of 40 (51%) women and 38 (49%) men, who had a sarcoma located near a joint, that is, hip, knee, and ankle joints for the lower extremity, and shoulder, elbow, or wrist joints for the upper extremity, were accrued during the period 1977–1994 at the Roswell Park

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Cancer Center. Of these, 64 were located in the lower extremity and 14 in the upper extremity. Sixteen patients were referred with a locally recurrent tumor, while the remainder had a primary tumor. The mean age of the patients at diagnosis was 43 years, and the median 39 years. These patients were compared with our overall experience with extremity sarcomas consisting of 215 patients accrued within the same period.

Survival time was calculated from the date of resection to the date of last follow-up or death. Disease-free survival was calculated from the date of resection to that of first recurrence or death, whichever occurred first. The Kaplan-Meier method was used to estimate overall and disease-free survival [1]. Tests of significance with respect to survival distributions were based on the log-rank test [2]. Cox's proportional hazards model was used for multivariate analysis.

## RESULTS

Surgical treatment consisted of local excision in 10 (13%), wide excision in 56 (72%), and amputation in 12 (15%). Of the amputations, six were posterior flap hemipelvectomies for extensive sarcomas of the iliac fossa crossing over the hip joint.

Preoperative radiation was given to two patients, intraoperative radiation to one patient, and postoperative radiation to 23 patients. These were patients considered to have narrow surgical margins, that is, <2 cm intracompartmental margin. Postoperative radiation was started about 3 weeks after the operation in cases of primary closure and about 5 weeks later when a skin graft was used. A dose of 4,500 cGy was delivered to the whole operative area; the field was then restricted to the area of narrow margin, the total tumor dose reaching 6,000 cGy over 6 weeks with a fractionation schedule of 200 cGy/day, 1,000 cGy/week, using 4 or 6 mEv X-rays with source to skin distance of 100 cm or more, and a bolus along the surgical scar to neutralize the skin-sparing effect. Anteroposterior and posteroanterior ports were used and every effort was made to preserve a strip of tissue on the medial or lateral aspect of the extremity outside of the radiation field for the lymphatic drainage of the extremity.

The histologic subtypes are depicted in Table I. Grade I was identified in 15 (21%), grade II in 17 (23%), and grade III in 41 (56%). The specific grade was not available in five patients. The mean diameter of the tumors was 8 cm, median 6.5 cm. During the postoperative period, wound infection occurred in 9 of 78 patients (12%), hematoma in 5 (6%), and other complications in 16 (20%).

At a mean follow-up of 69 months, median 56 months, local recurrence was noted in 16 patients (20%). The incidence of local recurrence in the surgery alone group was 15% (8/52), and 31% (8/26) in the group with ad-

TABLE I. Sarcomas Near a Joint: Histologic Subtypes

Subtype	N	(%)
Malignant fibrous histiocytoma	15	19
Synovial sarcoma	11	14
Liposarcoma	11	14
Leiomyosarcoma	10	13
Fibrosarcoma	7	9
Malignant schwannoma	5	6
Hemangiosarcoma	4	5
Spindle cell sarcoma	2	3
Clear cell sarcoma	2	3
Unclassified	6	8
Others	5	6

juvant radiation,  $P = 0.11$ . There was no significant difference between the two groups regarding tumor grade or size, but all patients in the surgery alone group had as narrowest intracompartmental margin one >2 cm and those in the surgery plus radiation group one  $\leq 2$  cm. Of the 16 patients with local recurrence 9 (56%) required amputation for its control.

The estimated 5-year survival rate was 68% (disease-free 60%), and 10-year survival rate 60% (disease-free 56%) (Fig. 1). Survival varied significantly according to grade ( $P = 0.01$ ). The estimated 5-year rate was similar for grades I and II (77% and 89%, respectively, but lower for grade III (52%). In Cox's regression analysis, survival varied significantly ( $P = 0.01$ ) with the size of tumor as a continuous variable. When size was categorized as <5 cm or  $\geq 5$  cm, estimated 5- and 10-year survival rates for patients with tumors <5 cm in diameter ( $n = 26$ ) were 81% and 71%; for those with tumors  $\geq 5$  cm ( $n = 49$ ), these rates were 61% and 54%, respectively ( $P = 0.10$ ). The precise diameter of the tumor was not available in three patients.

There was no significant difference in survival ( $P = 0.34$ ) according to surgical treatment, with a 5-year rate of 78% after local excision, 70% after wide excision, and 50% after amputation. The respective local recurrence rates after each surgical treatment were 4/10 (40%), 11/56 (20%), and 1/12 (8%),  $P = 0.20$ . There was no significant difference in the composition of the surgical treatment groups according to gender, age at diagnosis, grade or size of the tumor. There was a difference with regard to tumor location ( $P = 0.001$ ) in that local excision was more frequently performed in the upper extremities and wide excision or amputation in the lower extremities.

There was no difference in the 5-year survival rate according to referral status (primary or locally recurrent), the rate for both groups being 68%. The local recurrence rate in the primary tumor group was 20% and in the group referred with local recurrence it was 25%.

On multivariate analysis considering age at diagnosis, gender of the patient, size (as a continuous variable),

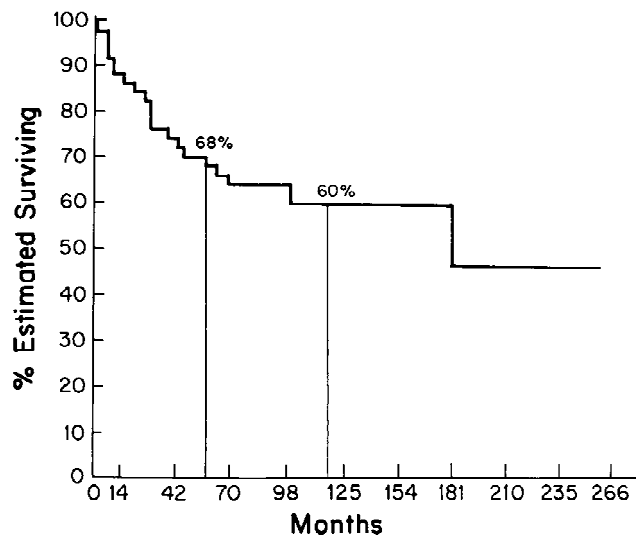


Fig. 1. Overall survival of patients with soft tissue sarcomas of the extremities located near joints.

grade, location of the tumor (upper or lower extremity), and type of resection, the only factors that were independent, significant predictors of survival were size of tumor ( $P = 0.02$ ) and grade ( $P = 0.05$ ).

The group of extremity sarcomas near joints (JS) was compared to our experience with the overall extremity sarcomas (OA). The frequency of the various grades in the JS group were 21% for grade I, 23% for grade II, and 56% for grade III, as noted above. The respective rates in the OA group were 26/215 (12%) for grade I, 57/215 (27%) for grade II, and 132/215 (61%) for grade III. There was no significant difference in grade composition between the two groups ( $P = 0.21$ ). The JS group had tumors <5 cm in 26/75 (35%) and  $\geq 5$  cm in 49/75 (65%), while the respective rates in the OA group were 51/214 (24%) and 163/214 (76%) ( $P = 0.07$ ). In the JS series 26/78 (33%), and in the OA series 51/215 (24%) were given adjuvant radiation ( $P = 0.10$ ). The local recurrence rate was 16/78 (20%) in the JS group and 31/214 (14%) in the OA group ( $P = 0.21$ ). The rate of amputation at initial management was 12/78 (15%) for the JS group, and 17/215 (8%) for the OA group ( $P = 0.08$ ). The estimated 5-year survival rate was 68% for the JS group and 60% for the OA group. The confidence intervals for the 2-, 5-, and 10-year survival rates for the two groups overlapped, suggesting no significant difference between the survival curves of the two groups. There was no significant difference between the JS and OS groups regarding the major prognostic indicators (i.e., grade and size), although the OA group tended to have higher grade and larger tumors; there was no significant difference regarding the initial amputation rate or the local recurrence rate between the two groups although the JS group tended to have a higher rate of amputation and local recurrence.

## DISCUSSION

The limb preservation rate in our overall series of extremity sarcomas has been 94%, the rate of amputation 6% and the rate of local recurrence 14% [3]. Similar rates have been reported in most modern series [4]. The rate of local recurrence for extremity soft tissue sarcomas in modern series using combination of modalities has ranged from 9% to 15% [5–9], although higher rates (22%) [10] have also been reported.

The present series illustrates the difficulties arising when soft tissue sarcomas are located near joints. Part of the difficulty is the intellectual challenge to the surgeon, in devising appropriate incisions for exposure and in striving for wide margins while major nerves and vessels are preserved in the more confined space near a joint as compared to the more expansive portions of the extremity between joints. The initial rate of amputation in the present series was 15%. Furthermore, the rate of local recurrence was 20%. Of the 16 patients with local recurrence, 9 (56%) required amputation bringing the overall rate of amputation to 21/78 (27%). In the most recent analysis of our overall extremity sarcomas series, the rate of amputation was 8% and the rate of local recurrence 14%, although the overall series tended to have higher grade and larger tumors compared to the near-joint sarcoma series.

In the present series, local recurrence was noted in 8/52 (15%) of the patients treated with surgery alone who had a presumably adequate surgical margin, and in 8/26 (31%) patients with narrow surgical margin and adjuvant radiation. This finding is consistent with our overall series of extremity sarcomas for the same period, which suggests that wide excision alone is preferable to local excision plus radiation. In about 70% of our patients, it was possible to perform a wide resection. Of course, one may counter that wide excision plus radiation may be even better provided that the latter is given cautiously to avoid some of its complications. However, the above results indicate that in the present era of combination of modalities, it is still important to strive for a wide surgical margin at least in anatomical areas amenable to this approach. The groups of surgery alone and surgery plus adjuvant radiation are not comparable since the former group consisted mostly of patients considered to have an adequate margin and the latter group of patients with narrow margins. In comparison with historical data from the same institution showing 65% local recurrence rate after local excision alone [11], which in some reports is as high as 90% [12], the 31% local recurrence rate achieved in the present series after local excision plus radiation (similar to the 30% local recurrence rate observed in another series after marginal resection plus brachytherapy [13]) clearly demonstrates the effective-

ness of adjuvant radiation in reducing the rate of local recurrence after less than wide resection.

The survival of the patients varied significantly according to grade. The difference between grade I and II tumors and grade III tumors was significant ( $P = 0.01$ ), but the difference between grades I and II was not. These findings support the notion expressed by some pathologists that it may be more expedient to distinguish sarcomas simply into high and low grade [14]. The estimated 5-year survival rate was 68% similar to the survival noted in overall extremity sarcomas (66%) [3]. Adjuvant chemotherapy in adult soft tissue sarcomas still remains investigational [15].

In conclusion, soft tissue sarcomas extending to or crossing joints seem to present higher technical difficulties for their local control, manifested by a tendency for higher local recurrence rate (20%) and a higher ultimate amputation rate (initially 15% and ultimately 27%) than those observed in overall extremity sarcoma cases. An increased vigilance in obtaining a wide surgical margin and more frequent use of adjuvant radiation may help improve the local control rates and decrease the rate of amputations. Importantly, extremity sarcomas near joints have similar survival rates as the overall extremity sarcomas.

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